REMARKS

The foregoing amendment amends Claims 1, 8, 9 and 13 and cancels Claim 7. Upon entry of the foregoing amendment, Claims 1-3, 5, 6, 8, 9 and 13-16 will be pending in this application. For the reasons set forth below, Applicant believes that the rejections should be withdrawn and that this application is in condition for allowance.

REJECTION OF CLAIM 8 UNDER 35 U.S.C. 101

The Examiner rejected Claim 8 under 35 U.S.C. 101 as being directed to non-statutory subject matter. More specifically, the Examiner alleged that Claim 8 is not a statutory process, because while Claim 8 recites a series of steps or acts to be performed, Claim 8 does not transform underlying subject matter or positively tie to another statutory category that accomplishes the claimed method steps.

Claim 8 has been amended to clarify that the visualization processing method for generation of a stereoscopic image based on a vector field includes "displaying on a display the two-dimensional plane with the indication." As amended, Claim 8 transforms data representing a vector field into a visual depiction of a physical object on a display. Claim 8 is directed to statutory subject matter. Accordingly, the rejection of Claim 8 under 35 U.S.C. 101 should be withdrawn.

DOUBLE PATENTING

The Examiner advised that should Claim 1 be found allowable, Claim 7 will be objected to under 37 C.F.R. 1.75 for being a substantial duplicate thereof. As mentioned above, Claim 7 has been cancelled. Accordingly, the potential double patenting objection to Claim 7 is now moot.

REJECTION OF CLAIMS 1-3, 7-9 AND 13-14 UNDER 35 U.S.C. 103(a)

The Examiner rejected Claims 1-3, 7-9 and 13-14 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,272,448 to Ishii ("Ishii") in view of "Topographical

Feature Representation by Openness Maps," by R. Yokoyama *et al.* ("Yokoyama"). As discussed below, this rejection is respectfully traversed.

CLAIM 1

Amended Claim 1 requires that the visualization processing system for generation of a stereoscopic image based on a vector field includes a set of computer programs which comprise a second subset for "determining an elevation degree as an aboveground opening" a third subset for "determining a depression degree as an underground opening," and a fourth subset for "synthesizing the elevation degree and the depression degree in a weighting manner to determine an elevation-depression degree at said region of the plane" connecting the sequence of coordinate points.

Ishii discloses an apparatus and method for reproducing a digital terrain model ("DTM") from contour data with geomorphological consistency and natural features including fine folds. *See*, Col. 1, ll. 65 – Col. 2 ll. 2. The method of Ishii includes "setting an initial terrain model calculated as a function defined on a two-dimensional plane from contour data," and "producing a terrain model by solving a boundary value problem including an operator which smoothes elevational values of a terrain model along flowing water lines or their neighborhoods with the contour data as boundary values by an iterative method with said initial terrain model." Col. 9, ll. 49-57.

More specifically, Ishii discloses that the domain D is quantized by dividing D into NxN square blocks and each block is expressed by a pair of integers (x, y) (x, y = 0, 1, 2, . . ., N-1). Col. 3, ll. 6-9. Contour lines are one-dimensional subsets of D. The contour lines and their elevational values are expressed by C_1, C_2, . . ., and v_1, v_2, . . ., respectively. *See,* Col. 3, ll. 13-15; and Fig. 3. An operator T operates on a functional space defined on a two-dimensional plane and transforms a two-dimensional array h into a two-dimensional array h', such that h' = T(h). Col. 3, ll. 20-23. A boundary value problem for the operator is to solve h=T(h) under the boundary condition h(x, y) = v for every point (x, y) of C. "Since the equation itself is only a phenomenological model, it is meaningless to require much of the strictness of the solution." Col. 3, ll. 65-67.

According to an embodiment of Ishii, the calculational area of the operator is extended to execute the smoothing on a somewhat global area. Col. 6, ll. 19-21. The operation of T on DTM h is defined by the following description. Initially, the gradient vector field, grad h of DTM h is determined. Col. 6, ll. 25-26. From the vector field, a discrete integral calculation is executed to obtain a flowing water line c(t) consisting of consecutive lattice points, such that $c(t) = (c_1(t), c_2(t))$ for the inner product $(c(t)-c(t-1), c(t+1)-c(t)) > 0$. Col. 6, ll. 27-36. In the case where c(t) does not terminate in a necessary area for smoothing, a smoothing operator T1 whose operation h' = T1(h) is defined by $h'(x, y) = \Sigma w(c(t) - (x, y))$ is applied, where the sum Σ is taken for every t meeting a condition of the weight $w(c(t)-(x, y)) \neq 0$. Col. 6, ll. 37-52.

In cases other than those described above, it is determined whether a point (x, y) belongs to a ridge-valley area or not. A ridge-valley area denotes an area where a ridge or a valley exists. A point is in a ridge-valley area if $a_+ * a_- > 0$ or $b_+ * b_- > 0$, where $a_+ = h(x+1, y) - h(x, y)$, $a_- = h(x-1, y) - h(x, y)$, $b_+ = h(x, y+1) - h(x, y)$, and $b_- = h(x, y-1) - h(x, y)$. Col. 6, ll. 54-67. For points in the ridge-valley area, a smoothing operator T2 whose operation h' = T2(h) is defined by $h'(x, y) = (h(x, y) + w_d(x, y) * h_L(x, y))/(1+w_d(x, y))$ is applied, where h_L is (a simple average) such that $h_L(x, y) = (h(x-1, y) + h(x+1, y) + h(x, y-1) + h(x, y+1))/4$, and $w_d(x, y)$ is a weight depending on the (simple binary or Yes/No) degree of "ridge or valley" on a point (x, y), whereas the weight w_d may be a function of Laplacian h (physically speaking, the amount of water flow into a point), or an increasing function of a distance from a point where the gradient vector vanishes, and h_L may be replaced by some two-dimensional non-linear filter. *See*, Col. 7, ll. 1-18. For points in other areas, a smoothing operator whose operation is defined by $h'(x, y) = h_L(x, y)$ is applied. Col. 7, ll. 19-21.

A. Second and Third Subsets

As mentioned above, Claim 1 requires a second subset for determining an elevation degree as an aboveground opening at a region of a plane connecting the sequence of coordinate points and a third subset for determining a depression degree as an underground opening at the region of the plane connecting the sequence of coordinate points.

According to an embodiment of the present invention, a second processing file 62 is adapted to verify, for a respective plane region S_m, a local region L_m^+ at an obverse side (Z+ side) of the curved plane S residing within a prescribed radius from a focused point Q_m thereof, and determine a degree of openness defined thereby Ψ_m^+ about the focused point Q_m (Fig. 2, process P2), storing it as an elevation degree of the plane region S_m. [0083].

According to the same embodiment, a third processing file 63 is adapted to verify, for the plane region S_m, a local region L_m^- at a reverse side (Z- side) of the curved plane S residing within the prescribed radius from the focused point Q_m, and determine a degree of openness defined thereby Ψ_m^- about the focused point Q_m (Fig. 2, process P3), storing it as a depression degree of the plane region S_m. [0084].

As detailed above, Ishii determines whether a point (x, y) belongs to a ridge-valley area or not. A ridge-valley area denotes an area where a ridge or a valley exists. A point is in a ridge-valley area if $a_+ * a_- > 0$ or $b_+ * b_- >0$, where $a_+ = h(x+1, y) - h(x, y)$, $a_- = h(x-1, y) - h(x, y)$, $b_+ = h(x, y+1) - h(x, y)$, and $b_- = h(x, y-1) - h(x, y)$. *See*, Col. 6, ll. 53-67.

The parameter $a_+ = h(x+1, y) - h(x, y)$, is a simple difference in elevation that a right adjacent block (x+1, y) has (in a course of iteration) to the block (x, y), which is a simple difference in elevation that a left adjacent block (x-1, y) has (in the same course of iteration) to the block (x, y) in an opposite sense of the X-axis direction. Thus, the criterion $a_+ * a_- > 0$ means that the scalar product $a_+ * a_-$ gives a positive value, if the differences have identical sign values (+ and +; or - and -), because the block (x, y) is "higher or lower" than both adjacent blocks (x+1, y) and (x-1, y) in the X-axis direction. If the sign values of the differences have different signs (+ and -; or - and +), the consecutive three blocks (x-1, y), (x, y), and (x+1, y) may be lying on a slope in the X-axis direction. If either value is null (0 and +; 0 and -; + and 0; or - and 0), the block (x, y) may constitute a cliff between adjacent blocks in the X-axis direction. If both values are null (0 and 0), the three blocks may be lying on a flat plane in the X-axis direction.

Likewise, the criterion $b_+ * b_- >0$ means that block (x, y) is "higher or lower" than both adjacent blocks (x, y+1) and (x, y-1) in an orthogonal Y-axis direction. Thus the condition if $a_+ * a_- > 0$ or $b_+ * b_- >0$ means that the point (x, y) is higher or lower than both

adjacent points in one of two orthogonal directions, as also apparent from the phrase "the degree of ridge or valley." *See*, Col. 7, ll. 11.

Ishii does not teach or suggest separately determining if the point (x, y) is higher or if the point (x, y) is lower to determine an elevation degree and a depression degree. Ishii does not describe or suggest, "a second subset thereof for determining an elevation degree as an aboveground opening at a region of the plane connecting the sequence of coordinate points" and "a third subset thereof for determining a depression degree as an underground opening at said region of the plane connecting the sequence of coordinate points," as required by Claim 1.

B. Fourth Subset

Claim 1 requires a fourth subset for synthesizing the elevation degree and the depression degree in a weighting manner to determine an elevation-depression degree at the region of the plane connecting the sequence of coordinate points.

According to the same embodiment of the invention discussed above, a fourth processing file 64 is adapted to synthesize, for the plane region S_m, the elevation degree Ψ_m^+ and the depression degree Ψ_m^- in a weighting manner ($w^+\Psi_m^+ + w^-\Psi_m^-$) with a sharing proportion w^+: $w^-(w^+ + w^- = 0)$ determined in an end-fit manner, thereby determining a stereoscopic effect to be brought about the focused point Q_m by a local region $L_m(L_m^+, L_m^-)$ at obverse and reverse of the curved plane S residing within the prescribed radius (Fig. 2, process P4), storing it as an elevation-depression degree Ψ_m of the plane region S_m. [0085].

As detailed above, Ishii teaches in the case that a point (x, y) belongs to the ridge-valley area, the smoothing operator T2 whose operation h' = T2(h) is defined by $h'(x, y) = (h(x, y) + w_d(x, y) * h_L(x, y))/(1+w_d(x, y))$ is applied. Here $h_L(x, y)$ is defined as $h_L(x, y) = (h(x-1, y) + h(x+1, y) + h(x, y-1) + h(x, y+1))/4$, and $w_d(x, y)$ is a weight depending on the degree of ridge or valley on a point (x, y). Col. 7, ll. 1-18.

Ishii's h_L is a simple average of elevational values of four adjacent points in orthogonal X-axis and Y-axis directions about the point (x, y) (in an associated course of iteration). Ishii details that the degree of ridge or valley is given as a simple binary value "1" (Yes) or "0" (No) in accordance with the condition if $a_+ * a_- > 0$ or $b_+ * b_- > 0$, and should be

"1" in the case where the point (x, y) belongs to the ridge-valley area. Thus, the weight w_d is a simple constant on the point (x, y). Therefore, Ishii's operation $h'(x, y) = (h(x, y) + w_d(x, y) * h_L(x, y))/(1+w_d(x, y))$ is no more than {h(x, y) + (constant) * (average)}/{1+(constant)}, which represents a simple linear expression h' = A * h(x, y) + B * (average), where A and B are constants. Ishii determines the binary degree of "ridge or valley" on a point in a simple manner, for the necessary correction to estimate water flow lines between contour lines, in a ridge-valley area.

The operation taught by Ishii is not a synthesis of the elevation degree and depression degree. More specifically, Ishii does not teach or suggest synthesizing an elevation degree and a depression degree in any manner to determine an elevation-depression degree, at a region of a plane. Ishii begins with a set of scalar data on a number of contour lines, and uses computational iteration to estimate an imaginary plane to be as natural as possible for interconnection between the contour lines. *See*, Col. 2, ll. 35-40.

In contrast, Claim 1 processes a set of existing vector data mapped in a three-dimensional space, and uses the concepts of aboveground opening and underground opening in a synthesizing manner for a non-linear thinning of real data to generate a tone enhanced stereoscopic image. Claim 1 defines that the stereoscopic image is generated by synthesis of data on the elevation degree of a region and data on the depression degree of the same region. The synthesis of Claim 1 does not simply address problems associated with mutual cancellation between elevation and depression within the same region, but also provides increased emphasis on adjacent sets of consecutive extreme convex points, as well as an increased emphasis on adjacent sets of consecutive extreme concave points, resulting in a tone enhanced stereoscopic image.

Ishii does not describe or suggest "a fourth subset thereof for synthesizing the elevation degree and the depression degree in a weighting manner to determine an elevation-depression degree at said region of the plane connecting the sequence of coordinate points," as required by Claim 1.

C. Conclusion

Furthermore, with respect to the second and third subsets of Claim 1, the Examiner acknowledged that Ishii does not disclose determining an elevation degree "as an aboveground opening" and a depression degree "as an underground opening." The Examiner relied on Yokoyama for disclosing these limitations.

Yokoyama discloses the concepts of "overground angle and openness" and "underground angle and openness" which are generally known in the art. However, Yokoyama does not teach or suggest synthesizing the elevation degree and depression degree to determine the elevation-depression degree at the region of the plane connecting the sequence of coordinate points, as required by the fourth subset of Claim 1.

Ishii and Yokoyama do not disclose or even suggest the above described claimed features of the visualization processing system for generation of a stereoscopic image based on a vector field, as defined by Claim 1. None of the sections or corresponding figures of Ishii and/or Yokoyama, as cited by the Examiner, show otherwise. Accordingly, Claim 1 would not have been obvious to one of ordinary skill in the art at the time of the invention based on a modification of the Ishii system with the teachings of Yokoyama. Claim 1 is patentable over Ishii in view of Yokoyama.

Claims 7-9 and 13

Independent Claims 8, 9 and 13 contain similar elements as Claim 1 and have been similarly amended. Accordingly, for at least the same reasons discussed above, Claims 8, 9 and 13 are patentable over Ishii in view of Yokoyama.

As mentioned earlier, Claim 7 has been cancelled. Accordingly, the rejection of Claim 7 under 35. U.S.C. 103(a) is now moot.

Claims 2, 3 and 14

Claims 2 and 3 depend from Claim 1, and Claim 14 depends from Claim 13. Accordingly, for at least the same reasons discussed above, Claims 2, 3 and 14 are patentable over Ishii in view of Yokoyama.

REJECTION OF CLAIMS 5 AND 15 UNDER 35 U.S.C. 103(a)

The Examiner rejected Claims 5 and 15 under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Yokoyama as applied to Claims 1 and 13, and further in view of "Illuminating clay: a 3-D tangible interface for landscape analysis," by Piper *et al.* ("Piper"). As discussed below, this rejection is respectfully traversed.

Claim 5 depends from Claim 1, and Claim 15 depends from Claim 13. As discussed above in detail, Ishii and Yokoyama do not disclose or suggest the particular subsets defined by Claims 1 and 13. Piper does not disclose those particular subsets of Claims 1 and 13 either. Accordingly, for at least the same reasons discussed above Claims 5 and 15 are patentable over Ishii in view of Yokoyama and further in view of Piper.

Furthermore, Piper does not discuss or suggest the tone indication for a brightness of a color-toned indication of an inclination distribution. Piper does not disclose or suggest providing the color-toned indication of the inclination distribution in red colors, as required by Claim 5.

REJECTION OF CLAIMS 6 AND 16 UNDER 35 U.S.C. 103(a)

The Examiner rejected Claims 6 and 16 under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Yokoyama as applied to Claims 1 and 13, and further in view of "Solid Texturing o Riyo Shita 3-Jigen Nin'l Gamenjo ni Okeru Sensekibun Tatamikomiho," by Kikukawa *et al.* ("Kikukawa"). As discussed below, this rejection is respectfully traversed.

Claim 6 depends from Claim 1, and Claim 16 depends from Claim 13. As discussed above in detail, Ishii and Yokoyama do not disclose or suggest the particular subsets defined by Claims 1 and 13. Kikukawa does not disclose those particular subsets of Claims 1 and 13 either. Accordingly, for at least the same reasons discussed above Claims 6 and 16 are patentable over Ishii in view of Yokoyama and further in view of Kikukawa.

CONCLUSION

The foregoing is submitted as a complete response to the Office Action identified above. Applicant believes this application is now in condition for allowance and solicits a notice to that effect. If there are any issues that can be addressed via telephone, the Examiner is asked to contact the undersigned at 404.532.6946. The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, to Deposit Account No. 11-0855.

Respectfully submitted,

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